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SPECIFICATION FOR BOOKBINDING LEATHER

(Third Reprint MAY 1997)

UDC 675.7.024 : 686.12.03

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BUREAU OF INDIAN STANDARDS
MAKAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4

January 1965

AMENDMENT NO. 2 SEPTEMBER 2005
TO
IS 2960 : 1964 SPECIFICATION FOR BOOKBINDING LEATHER

(*Page* 7, *clause* **5.1**, *line* 3) — Substitute 'IS 582 : 1970*' *for* 'IS : 582 - 1954*'.

(*Page* 7, *clause* **6.1**, *line* 3) — Substitute 'IS 582 : 1970*' *for* 'IS : 582 - 1954*'.

(*Page* 7, *clause* **6.5**, *line* 2) — Substitute 'IS 1070 : 1992†' 'IS : 1070 - 1960†'.

(*Page* 7, *clause* **6.6**, *line* 5) — Substitute 'IS 196 : 1966‡' *for* 'IS : 196 - 1950‡'.

(*Page* 7, *footnotes*) — Substitute the following for the existing:

'*Methods of chemical testing of leather *(first revision)*.
†Regeant grade water — Specification *(third revision).*
‡Atmospheric conditions for testing *(revised).*

(CHD 17)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 JULY 1998
TO
IS 2960 : 1964 SPECIFICATION FOR BOOKBINDING LEATHER

[*Page* 5, *Table* 1] — Substitute the following for the existing table:

Table 1 Chemical Requirements of Bookbinding Leather

Sl No.	Characteristic	Requirement	Method of Test, Ref to Cl No. in IS 582 : 1970*
(1)	(2)	(3)	(4)
i)	Oils and fats, percent by mass	5.0 to 8.0	LC:4
ii)	Water soluble matter, percent by mass, *Max*	6.0	LC:6
iii)	Insoluble ash, percent by mass, *Max:*		LC:8:
	a) Vegetable tannage 1.0	5.0	
	b) Full-chrome tannage, or of chrome-vegetable combination tannage		
iv)	*p*H of water solubles, *Min*	3.5	LC:18
v)	Hide substance, percent by mass	45.0 to 55.0	LC:21
vi)	Degree of tannage for vegetable tanned leather	50.0 to 60.0	LC:21
vii)	Iron to pass the test		LC:24
viii)	Copper	do	LC:25
ix)	Chrome content (as Cr_2O_3), percent by mass, *Min:*		LC:10
	a) Full chrome tannage	3.0	
	b) Chrome and vegetable combination tannage	2.0	

NOTE – Calculation of values for the requirements under (i) to (iii), (v), (vi) and (ix) shall be done on moisture free basis.

*Chemical tearing of leather — Method of sampling (*first revision*).

(*Page* 6, *clause* **3.8**) — Insert the following new clauses after **3.8**:

'**3.8.1** *Colour Fastness*

3.8.1.1 *Fastness to dry rubbing* — The bookbinding leather shall have fastness to dry rubbing of Grade 3 after 256 revolutions when tested in accordance with LF:9 of IS 6191 : 1971.

3.8.1.2 *Fastness to wet rubbing* — The book binding leather shall have fastness to wet rubbing of Grade 3 after 128 revolutions when tested in accordance with LF:9 of IS 6191 : 1971.'

(*Page* 6, *Table* 2) — Substitute the following for the existing table:

Table 2 Physical Requirement for Bookbinding Leather

Sl No.	**Characteristic**	**Requirement**	**Method of Test**	
			Cl No. in IS 5914 : 1970	Clause "
(1)	(2)	(3)	(4)	(5)
i)	Thickness, mm:			
	a) Range	0.7 to 0.9	L:P1	–
	b) Tolerance on individual thickness within the range	- 0.1		
ii)	Grain strength (lastometer), kg/cm thickness, *Min*	200.0	—	Appendix A
iii)	Grain strength (folding test)	To pass the test	—	6.1.4
iv)	Tearing strength, kg/cm thickness, *Min*	8.0	LP:7	—

*Methods of sampling and test for vegetable and chrome tanned leathers.

(*Page* 7, *clause* **6.1.3**, *line* 2) — Substitute 'Appendix A' *for* 'Appendix C'.

(*Page* 7, *clause* **6.2**, *line* 2) — Substitute 'LF:7 of IS 6191 : 1971' *for* 'Appendix D'.

(*Page* 7, *clause* **6.3**, *line* 2) — Substitute, 'LF:8 of IS 6191 : 1971' *for* 'Appendix E'.

(*Page* 7, *clause* **6.4**, *line* 2) — Substitute 'Appendix B' *for* 'Appendix F'.

(*Page* 8, *Appendix* A) — Delete the text.

(*Page* 9, *Appendix* B) — Delete the text.

(*Page* 11, *Appendix* C, *Title*) — Substitute 'Appendix A' *for* 'Appendix C' and renumber the subsquent clauses.

(*Page* 12, *Appendix* D) — Delete the text.

(*Page* 15, *Appendix* E) — Delete the text.

(*Page* 16, *Appendix* F) — Substitute 'Appendix B' *for* 'Appendix F' and renumber sebsequent clauses.

(CHD 017)

Indian Standard
SPECIFICATION FOR BOOKBINDING LEATHER

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Indian Standard
SPECIFICATION FOR BOOKBINDING LEATHER

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 19 September 1964, after the draft finalized by the Leather Sectional Committee had been approved by the Chemical Division Council.

0.2 Use of leather for bookbinding purposes is quite old. It is preferred to cloth or paper largely because of its greater resistance to wear and tear in handling and consequently there is a greater shelf life for leather bound books.

0.2.1 With the rapid expansion and growth of libraries and reading rooms as well as the reading habits of people in our country, the demand for leather bound books has also increased tremendously. Apart from this, in view of the location of libraries in all types of climates, and in differently polluted atmospheres of industrial towns and in laboratories, the demand for good quality leather for bookbinding purposes cannot be over emphasized.

0.2.2 Bookbinding leather, as it is required to preserve costly and, at times, invaluable records and books, is in fact a choice material. Among many other requirements it has to be damp-proof, resistant to mildew and insect attack and should withstand rough handling. At the same time the eye appeal of bookbinding leather cannot be overlooked.

0.3 Realizing the importance of this type of leather coupled with the feeling that leathers used at present for bookbinding purposes are not giving satisfactory results in respect of some of their essential requirements, the Sectional Committee responsible for the formulation of this standard decided to lay down the basic requirements of the material in a standard on the subject.

0.3.1 In this standard, the peroxide test has been included to assess the resistance to ageing of bookbinding leather and is based on laboratory test data. The Committee at the time of finalizing the standard on the subject was of the opinion that satisfactory bookbinding leathers could be made which may not stand up to this peroxide test; it, therefore, felt that the peroxide method prescribed in this standard may be replaced in due course by less stringent methods, when authentic test data are made available.

0.3.2 This specification is intended to serve as a guide in assisting manufacturers in upgrading the quality of the material currently produced and also to aid consumers in selecting material of acceptable quality.

0.4 In the preparation of this standard, assistance has been taken from 'Official methods of analysis', Ed. 3, 1957, published by the Society of Leather Trades Chemists, London.

0.5 This standard contains clauses **3.2**, **3.4** and **4.2** which call for agreement between the purchaser and the supplier.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements and the methods of tests for vegetable, chrome and chrome-vegetable combination tanned book-binding leather.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 1640-1960† shall apply.

3. REQUIREMENTS

3.1 Raw Material — The raw material shall be of good quality sheep, goat or calf skin or cow hide, free from grain defects and insect damages.

3.2 Tanning — The hides and skins may preferably be tanned wholly with vegetable tanning materials using maximum tannins of pyrogallol group in the blend; or it may be chrome tanned or chrome-vegetable combination tanned with or without the use of syntans.

3.3 Appearance and Finish — The leather shall be of uniform thickness and shall be finished with full grain in fast colours. The leather shall not be treated with any compound of iron, copper or other similar types of metallic compounds. They shall be suitably treated with iron sequestering agents or with organic salts, like acetate, citrate and lactate or with both, depending on the tannage so as to prevent rotting.

3.4 Treatment to Promote Mould Resistance — The leather shall be given suitable anti-mildew treatment, so as to show no growth (*see* Note) of mildew in excess of what has been agreed upon between the

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*Rules for rounding off numerical values (*revised*).

†Glossary of terms relating to hides, skins and leather.

purchaser and the supplier, when examined visually or otherwise, after the completion of the test prescribed in **6.2.**

NOTE — According to the trade parctice, the growth of mildew in the test may be defined as vigorous, moderate, slight, very slight or nil. Depending upon the needs, the assessmentof the mildew test shall be as agreed to between the purchaser and the supplier. Attempts are being made to state the extent of mildew growth unambiguously.

3.5 Resistance to Perspiration — The material shall be resistant to perspiration.

3.5.1 The material shall be considered as resistant to perspiration ifit is assessed good or very good, when examined after completion of test prescribed in **6.3.**

3.6 Resistance to Ageing — The leather shall retain its shape and show no crackiness or crumbling, when examined after completion of the test prescribed in **6.4.**

3.7 Chemical Requirements — The bookbinding leather shall comply with chemical requirements given in Table 1. References to relevant clauses of IS : 582-1954* and to the Appendices are given in col 4 and 5, respectively, of Table 1.

TABLE 1 CHEMICAL REQUIREMENTS OF BOOKBINDING LEATHER

SL No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST, REF TO	
			Cl No. in IS : 582-1954*	Appendix in this Standard
(1)	(2)	(3)	(4)	(5)
i)	Oils and fats, percent by weight, *Max*	5.0 to 8.0	8	—
ii)	Water soluble matter, percent by weight, *Max*	6.0	10	—
iii)	Insoluble ash, percent by weight, *Max:*		12	—
	a) Vegetable tannage	1.0		
	b) Full-chrome tannage, or of chrome-vegetable combination tannage	5.0		
iv)	*p*H of water solubles, *Min*	4.5	13	—
v)	Hide substan , percent by weight	45.0 to 55.0	16	—
vi)	Degree of tannage for vegetable tanned leather	50.0 to 60.0	17	—
vii)	Iron	To pass the test		A
viii)	Copper	-do-		B

NOTE — Calculation of requirements of characteristics (i) to (iii) and (v) and (vi) are done on 14 percent moisture basis.

*Methods of sampling and test for vegetable and chrome tanned leathers.

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*Methods of sampling and test for vegetable and chrome tanned leathers.

3.8 Physical Requirements — The bookbinding leather shall also comply with the requirements given in Table 2. References to the relevant methods of test for various determinations have been indicated in the table.

TABLE 2 PHYSICAL REQUIREMENTS FOR BOOKBINDING LEATHER

SL No.	CHARACTERISTIC	REQUIREMENTS	METHODS OF TEST, REF TO	
			Cl No. in IS : 582-1954*	Cl or Appendix in this Standard
(1)	(2)	(3)	(4)	(5)
i)	Thickness, mm:		20	—
	a) Range	0.7 to 0.9		
	b) Tolerance on individual thickness within the range, mm	± 0.1		
ii)	Grain strength (lastometer), kg/cm thickness, *Min*	300.0	—	Appendix C
iii)	Grain strength (folding test)	To pass the test	—	6.1.4
iv)	Tearing strength, kg/cm thickness, *Min*	8.0	24	—
v)	Colour fastness to rubbing (with 10 strokes only)	To pass the test	26	—

*Methods of sampling and test for vegetable and chrome tanned leathers.

4. MARKING AND PACKING

4.1 The area of the leather shall be clearly marked on the flesh side on each piece.

4.2 The leather shall be packed as agreed to between the purchaser and the supplier.

4.3 The packages shall be marked with the name of the manufacturer, recognized trade-mark, if any, number of pieces of leather, month and year of manufacture.

4.4 BIS Certification Marking

The product may also be marked with Standard Mark.

4.4.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

5. SAMPLING

5.1 For the purpose of ascertaining the conformity of the material to this specification, the scale of sampling shall be as prescribed under IS : 582-1954*.

5.2 Criteria for Conformity — The individual samples tested shall comply with the requirements prescribed in **3.**

6. TEST METHODS

6.1 Chemical and physical tests shall be carried out in accordance with the methods prescribed below and in the relevant clauses of IS : 582-1954* and the appendices, as indicated against respective characteristics in Tables 1 and 2.

6.1.1 *Testfor Iron* — The material shall be tested in accordance with the method prescribed in Appendix A.

6.1.2 *Test for Copper* — The material shall be tested in accordance with the method prescribed in Appendix B.

6.1.3 *Grain Strength (Lastometer Method)* — The material shall be tested in accordance with the method prescribed in Appendix C.

6.1.4 *Grain Strength (by Folding Test)* — Fold the leather through 180° one hundred times repeatedly and continuously, taking care that the folding each time is at the same place. No grain crack shall occur at the fold.

6.2 Test for Assessing Resistance to Mildew Growth — The material shall be tested in accordance with the method prescribed in Appendix D.

6.3 Test for Assessing Resistance to Perspiration — The material shall be tested in accordance with the method prescribed in Appendix E.

6.4 Test for Assessing Resistance to Ageing — The material shall be tested in accordance with the method prescribed in Appendix F.

6.5 Quality of Reagents — Unless specified otherwise, pure chemicals (*see* Note) and distilled water *(see* IS : 1070- 1960†) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

6.6 Standard Atmospheric Conditions for Physical Testing — Unless otherwise required by the particular method of test, the test specimens shall be conditioned to a moisture equilibrium in an atmosphere of 65±2 percent relative humidity and temperature of 27° ± 2°C (*see* IS : 196-1950‡) and, if possible, tested in that atmosphere or soon after removal from that atmosphere.

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*Methods of sampling and test for vegetable and chrome tanned leathers.

†Specification for water, distilled quality (*revised)*.

‡Atmospheric conditions for testing.

APPENDIX A

(*Clause* 6.1.1)

DETERMINATION OF IRON

A-1. OUTLINE OF THE METHOD

A-1.1 A known quantity of leather is ashed and the amount of iron present is determined colorimetrically in Nessler tubes by thiocyanate method.

A-2. APPARATUS

A-2.1 Nessler Tabes — 50 ml capacity.

A-3. REAGENTS

A-3.1 Faming Nitric Acid

A-3.2 Bromine Water — saturated.

A-3.3 Concentrated Hydrochloric Add — conforming to IS : 265-1962*.

A-3.4 Ammonium Hydroxide — 1:1 *(v/v)*.

A-3.5 Dilute Hydrochloric Acid — 1:1 *(v/v)*.

A-3.6 Dilute Sulphuric Acid — 1:1 *(v/v)*.

A-3.7 Potassium Permanganate Solution — approximately 0.1 N.

A-3.8 Potassium or Ammonium Thiocyanate Solution — Dissolve 10 g of potassium thiocyanate (or ammonium thiocyanate) in 100 ml of water.

A-3.9 Stock Iron Solution — Dissolve exactly 0.700 0 g of pure ferrous ammonium sulphate [$FeSO_4(NH_4)_2 SO_4,6H_2O$] in 50 ml of water and 20 ml of sulphuric acid, 1 : 4 (*v/v*) and add 0.1 N potassium permanganate solution drop by drop until a faint pink colour is obtained. Adjust the volume to one litre with water. The strength of this solution is ten times that of the standard solution. The keeping quality of this solution is better at this strength. Store this solution and use it when required.

A-3.10 Standard Iron Solution — Prepare a fresh solution by diluting 10 ml of the stock solution (**A-3.9**) to 100 ml with water. Each millilitre of this solution contains 0.000 01 g of iron (as Fe).

A-4. PROCEDURE

A-4.1 Ash 5 g of the material, after drying in the oven, in accordance with the method prescribed in **7** of IS:582-1954†. Moisten the carbon-free

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*Specification for hydrochloric acid (*revised*).

†Methods of sampling and test for vegetable and chrome tanned leathers.

ash with hot water. To this add five drops each of fuming nitric acid and bromine water. Heat slowly until the fumes cease to come out. Evaporate to dryness. Moisten the residue with water and digest it with 5 ml of concentrated hydrochloric acid over a water-bath for a few minutes, dilute with water and filter into a 250-ml beaker. Adjust the volume to approximately 75 ml (by boiling, if necessary) and make it faintly alkaline with ammonium hydroxide. Boil off the excess ammonia gently and allow the precipitated iron and aluminium hydroxides to coagulate.

A-4.2 Allow the solution to stand for a few minutes until the precipitate settles. Decant the supernatant liquid quickly through an asbestos Gooch filter, washed previously with hot dilute hydrochloric acid, water, ammonium hydroxide and water successively. Wash the precipitate three times with hot water, made faintly alkaline with five drops of dilute ammonium hydroxide per litre. Transfer the precipitate quantitatively to the filter and wash it four times with faintly ammoniacal hot water. Keep the combined filtrate and washings for the determination of copper.

A-4.3 Dissolve the precipitate on the filter paper by treating it with two lots of 20 ml dilute sulphuric acid and collect the solution. Wash the filter paper four times with dilute sulphuric acid and combine the washings with the solution. Add a few drops of potassium permanganate solution until the solution is slightly pink and transfer it to a 250-ml volumetric flask. Adjust the volume finally to the mark with dilute sulphuric acid.

A-4.4 Transfer 10 ml of dilute sulphuric acid and 5 ml of potassium thiocyanate solution to each of the two identical 50-ml Nessler tubes. To one of the Nessler tubes, add 10 ml of the made up solution (**A-4.3**) and make up the volume to 50-ml mark. To the second Nessler tube add one millilitre of standard iron solution and make up the solution to 50-ml mark.

A-5. RESULT

A-5.1 The material shall be considered to have passed the test if the intensity of the colour produced with the material is not greater than that produced in the control tube.

APPENDIX B

(*Clause* 6.1.2)

DETERMINATION OF COPPER

B-1. OUTLINE OF THE METHOD

B-1.1 A known quantity of the leather is ashed and the amount of copper present in the ash is determined colorimetrically in Nessler tubes by diethyldithiocarbamate method, after eliminating iron.

B-2. APPARATUS

B-2.1 Nessler Tubes — 50 ml capacity.

B-3. REAGENTS

B-3.1 Tetrasodium Pyrophosphate Solution — four percent *(w/v)* solution.

B-3.2 Gum Arabic Solution — one percent *(w/v)* solution.

B-3.3 Sodium Diethyldithiocarbamate Solution — 0.2 percent *(w/v)* solution. Dissolve the weighed quantity of sodium diethyldithiocarbamate in the requisite amount of copper-free water. Filter and keep in an amber coloured bottle protected from light.

B-3.4 Stock Solution of Copper — Dissolve 0.392 8 g of copper sulphate crystals ($CuSO_4,5H_2O$) in water containing a few drops of concentrated sulphuric acid and make up the volume to one litre.

B-3.5 Standard Solution of Copper — Prepare fresh solution by diluting 10 ml of the stock solution (**B-3.4**) to 100 ml with water. Each millilitre of this solution contains 0.000 01 g of copper (as Cu).

B-4. PROCEDURE

B-4.1 Heat the combined filtrate and washings from **A-4.2,** until the free ammonia is expelled. Cool and make up to 100 ml.

B-4.2 Transfer 10 ml of the made up solution to one of the Nessler tubes together with 10 ml of tetrasodium pyrophosphate solution and 5 ml of gum arabic solution. After carefully shaking, add sodium diethyldithiocarbamate solution and make up the volume to 50 ml with water. Carry out a control test as described above using 2 ml of standard copper solution in place of the made up solution.

NOTE 1 — Tetrasodium pyrophosphate solution sequesters manganese, calcium and magnesium salts.

NOTE 2 — Gum arabic solution prevents any separation of the coloured copper complex.

B-5. RESULT

B-5.1 The material shall be considered to have passed the test if the intensity of the yellow colour produced with the made up solution is not greater than that produced in the control test.

APPENDIX C

(*Clause* 6.1.3)

MEASUREMENT OF GRAIN STRENGTH (LASTOMETER METHOD)

C-1. OUTLINE OF THE METHOD

C-1.1 Circular leather discs of measured thickness are subjected to a load through a mechanism for thrusting a spherical ball to the point of rupture of grain and the load determined.

C-2. APPARATUS

C-2.1 Circular Metal Discs — Two circular metal discs having an opening in the middle; the outer disc with 2.22 cm as the diameter of the opening and the inner one with 1.45 cm as the diameter of the opening to hold the leather specimen. It should be possible to apply the load by turning these discs clockwise.

C-2.2 Metal Rod — A metal rod with a spherical head (0.64 cm diameter) which presses against the flesh side of the leather sample.

C-2.3 Steel Spring (Graph Spring) — The other end of the metal rod (*see* **C-2.2**) rests against one side of a flat steel spring.

C-2.4 Thickness Gauge — The other side of the steel spring (*see* **C-2.3**) presses against the foot of a thickness gauge.

C-2.5 Calibration Graph — Straight line graphs, calibrated with load in kg against gauge reading.

NOTE — These are usually supplied by the manufacturers of instruments.

C-2.6 Plane Mirror — A means to observe the image of the grain side of the leather specimen as the load is being applied, till the crackiness is noticed.

C-2.7 Mechanism — The thrust produced by the leather specimen is conveyed to the flat steel spring through the spherical head and metal rod. As the elastic properties of the steel spring are known, the bending of the steel spring is measured by the thickness gauge which could then be related to the load required to bend it through this extent.

C-3. SPECIMEN

C-3.1 The specimen required for test is a circular sample of leather (46 cm diameter) with two notches on the circumference diametrically opposite to each other.

C-4. PROCEDURE

C-4.1 The thickness at the middle of the leather specimen is measured by a thickness gauge. It is then held in between the two metal discs with the flesh side adjacent to the ball so that it is possible to see the grain surface from the outside. The load is gradually and slowly increased by turning the discs till a crack appears on the grain, as observed in the mirror. At this point the reading on the dial of the thickness gauge is noted. With the aid of the calibration graph, the thickness gauge is translated into load values.

C-5. RESULT

C-5.1 Calculate the strength of the grain as follows:

$$\text{Strength of grain, kg/cm thickness} = \frac{L}{t}\,.$$

where

L = load in kg at the time of first appearance of crack in the grain of the leather disc,

t = thickness in cm of the leather disc at the middle.

APPENDIX D

(*Clause* 6.2)

TEST FOR MILDEW RESISTANCE OF BOOKBINDING LEATHER

D-1. OUTLINE AND SCOPE OF THE METHOD

D-1.1 Untreated leathers as well as those leathers treated with agents to mould resistance are smeared, sprayed or swabbed with mixed spore suspension of species of mould found in tanned leathers and the resistance of such leathers to the growth of moulds is evaluated.

D-1.2 Conditions prescribed for sampling in this test method correspond to the conditions to which the bookbinding leather is subjected while in use, in different climatic conditions and to the normal storage conditions in vogue.

D-1.2.1 Accordingly, these samples are tested under different conditions to represent:

a) the repeated dampness and drying of leather and the consequent leaching out or migration of water soluble matter at room temperature,

b) under similar but more drastic conditions, and

c) the storage under normal conditions.

D-2. SAMPLE

D-2.1 Divide the samples into three portions and treat them as follows:

a) Weigh the samples of one portion and then leach by drumming for three hours in about 30 times their weight of water at 27° ± 2°C (*see* IS : 196-1950*). Drain the leached sample and blot them.

b) Keep the second portion of the sample for seven days at 45° ± 2°C in an oven with forced air circulation and leach as in (a) above, and

c) Test the third portion of the sample as received.

D-3. APPARATUS

D-3.1 Containers for Keeping Test Pieces — Any suitable glassware which may be conveniently stoppered, for example, jars, desiccators, glass tanks, etc, with greased covers to preclude loss of water vapour during the test may be used. The vessel may contain water at the bottom or cotton wool or clean sand previously saturated with boiling water. This is done to obtain 100 percent relative humidity at approximately 30°C.

NOTE — The same vessel shall not be used for simultaneous testing of samples treated with different fungicides†.

D-3.2 Incubator, Relative Humidity Cabinets — One capable of maintaining 45° ± 2°C with forced air circulation and another capable of maintaining 30° ± 2°C and 95 to 100 percent relative humidity.

D-4. STANDARD MIXED SPORE SUSPENSION

D-4.1 Standard mixed spore sand suspension† of the culture of species of moulds shall be used in the test. With each batch of such a suspension, a list showing the organisms incorporated therein as well as the last date before which the culture is to be used shall be furnished.

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*Atmospheric conditions for testing.

†At present only sand spore suspension of species of mould, usually found in tanned leathers, is supplied by the Central Leather Research Institute, Madras.

D-5. PROCEDURE

D-5.1 Cut four strips of 50 × 12 mm from the treated samples (**D-2.1**), dampen with sufficient water for about 5 minutes, smear, spray or swab with mixed spore suspension and then subsequently suspend them above a free water surface in a suitable covered vessel as described under **D-3.1.**

D-5.2 Viability Control — Simultaneously, carry out tests with control samples of leather not treated with fungicide.

D-5.2.1 If this untreated material fails to show any abundant growth of the test organism, the test shall be considered inconclusive and the whole test shall be repeated.

D-5.3 Incubation — Incubate the samples for 30 days at 30° ± 2°C and 95 to 100 percent relative humidity in the incubator, relative humidity cabinet, kept in the dark.

D-5.3.1 Examine the samples at frequent intervals, at least once a week, and note the date of the first appearance of mould growth.

D-6. ASSESSMENT OF RESISTANCE TO MOULD ATTACK

D-6.1 Presence or absence of mould growth as well as the extent of growth at the end of the incubation period may be assessed visually and indicated in the test report as vigorous, moderate, slight, very slight or nil*.

D-6.1.1 The test report shall also contain the following:

a) The number of samples tested;

b) Nature of the samples tested, (*a*), *(b)* or *(c)* (*see* **D-2.1**);

c) The date of incubation; and

d) The date of first appearance of mould growth.

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*According to the trade practice, growth of mildew in the test is defined as vigorous, moderate, slight, very slight or nil, visually. Depending on the needs, the assessment of mildew test shall be as agreed to between the purchaser and the supplier. Attempts are being made to devise a method for prescribing the rate and extent of mildew growth unambiguously.

APPENDIX E

(*Clause* 6.3)

TEST FOR ASSESSING RESISTANCE TO PERSPIRATION

E-1. OUTLINE OF THE METHOD

E-1.1 This method is intended for use in determining the effect of perspiration on leather. The leather is subjected to treatment with artificial perspiration and the cracking measured after bending the material through 180° round a mandrel.

E-2. SPECIMEN

E-2.1 The specimen shall be a rectangular leather 150 × 50 mm cut from an article or drawn as prescribed under **2.2.2** of IS : 532-1954*. It shall be free from mechanical damage.

E-3. APPARATUS

E-3.1 Air-Oven — a circulating air-oven capable of maintaining the required temperature within 2°C.

E-3.2 Mandrel — 50 mm in diameter.

E-4. REAGENTS

E-4.1 Artificial Perspiration Solution — a solution with a *p*H of 7.9 ± 0.2, prepared as follows:

Sodium chloride	10 g
Ammonium carbonate	4 g
Anhydrous disodium phosphate	1 g
Water	To make one litre

NOTE — If necessary, the *p*H of the solution shall be adjusted with ammonium carbonate or lactic acid.

E-5. PROCEDURE

E-5.1 Conduct the test at a temperature of 50° ± 2°C for a period of 24 hours.

E-5.2 Immerse the specimen in the artificial perspiration solution at 23° ± 1°C until its weight increases approximately by 20 percent. Immediately transfer the wet specimen from the solution to the constant temperature air-oven and maintain at the required temperature for the required period of time. Bend the aged specimen slowly with the grain side out through an angle of 180°, over a mandrel of 50 mm in diameter. Examine the bent specimen for cracks.

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*Methods of sampling and test for vegetable and chrome tanned leathers.

E-6. ASSESSMENT OF RESISTANCE TO PERSPIRATION

E-6.1 The specimen shall be assessed according to its resistance to cracking as follows:

Poor	Cracks completely across the specimen
Fair	Cracks approximately one-half across the specimen
Good	Cracks only along the edge of the specimen
Very Good	No cracks formed

APPENDIX F

(*Clause* 6.4)

TEST FOR ASSESSING RESISTANCE TO AGEING

F-1. OUTLINE OF THE METHOD

F-1.1 The leather is subjected to accelerated oxidation by exposing it to hydrogen peroxide under acidic conditions, and the visible deterioration of leather, if any, reported at the end of the test.

F-2. REAGENTS

F-2.1 Standard Sulphuric Acid — approximately 1.0 N.

F-2.2 Hydrogen Peroxide — ten volumes strength.

F-3. PROCEDURE

F-3.1 Place a piece of leather, 16 cm^2 and weighing from 2 to 5 g, on a glass plate and evenly treat it with sulphuric acid in the proportion of 1 ml of acid per gram of air-dry leather. This proportion is just enough to damp the leather (moisture content now about 65 percent) and to give it, when air dried, a sulphuric acid content of 5 percent. Allow the leather to dry at laboratory temperature, all the acid being absorbed and equilibrium with atmosphere gained in the course of 24 hours. Now add hydrogen peroxide evenly by drops in the proportion of 0.6 ml/g of leather. In the case of very thin leathers (weighing, say, 2 g or less) this proportion of hydrogen peroxide is not enough to damp the whole square evenly and the amount is increased to 1 ml/g of leather. Allow the damp piece to dry by leaving for 24 hours; then give a further daily dosage usually up to 6 days.

F-4. RESULT

F-4.1 At the end of 7 days, the pieces shall show no sign of visible crackiness, crumpling or any other deformity in shape.

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